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COLONISATION OF ANTS ON THE EXPOSED BANKS OF THE CANNING DAM RESERVOIR

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Abstract

The plants, ants and certain epigaeic invertebrates were sampled on the banks of the Canning Dam reservoir which had become exposed as a result of several years drought.

At least 26 plant and 17 ant species had colonised the reservoir banks within 67 months of exposure. All but three ants present were also residents of the adjacent forest. Most were generalist feeders which nested in soil or subterranean dead wood. The ant species present took between about 1.5 and 67 months to colonise the banks. The species composition of ants was very similar to those recolonising nearby bauxite mined areas.

Introduction

The south-west of Western Australia has experienced below average rainfall since 1975. As a result, the water in the reservoirs in this area is at an extremely low level. The exposed ground, which was previously inundated, is in the process of being colonised by a range of native and exotic plant species, and various invertebrate taxa are also becoming prominent. These conditions provide a natural situation for the study of species capable of colonising freshly available land.

The present study records the ants which have colonised recently exposed ground on the banks of the Canning Dam reservoir, 35 km SE of Perth and compares the species here with those colonising the nearby mined areas. Some notes are also given on the abundance of other invertebrates and plant species occurring on the reservoir banks.

Another study of invertebrate succession, with particular reference to ants, is in progress in rehabilitated bauxite mines situated at Del Park and Jarrahdale, respectively 90 and 45 km SE of Perth (Majer, 1978). Here attention is being focused on the sequence of ant species which colonise the mined areas.

Site description and methods

Canning Dam reservoir is situated in the northern Jarrah (*Eucalyptus marginata* Donn. ex Sm.) forest. Construction of the reservoir was commenced in 1933 and it was opened in 1940. The dam wall is 66 metres high and the sides of the reservoir usually follow the original contours of the valley. All vegetation was removed prior to flooding of the valley while topsoil and some subsoil were displaced in certain areas near the dam. In most areas the banks of the reservoir are covered in clay, silt or the original topsoil. Large granite outcrops dominate certain areas and many stumps of dead trees are present.

By inspection of the monthly water level records it was possible to determine the period of continuous exposure of sections of the surrounding bank. As a result, zones of ground along the banks were identified which had been exposed for 1.5, 5, 16, 54 and 67 months following depression of water levels. The respective zones average a linear distance of 87, 69, 55, 29 and 4 metres from the forest margin.

Ten transects, spaced at 10 m intervals, were marked out from the top of the banks to water level along both the north-west and north-east banks of the reservoir. The adjacent forest was not sampled since the ant fauna of this region is reasonably well known (J. D. Majer, unpublished data). Single pitfall traps were installed in April, 1980, at points representing the five exposure zones on each of the twenty transects. Traps consisted of Pyrex test tubes of 18 mm internal diameter and 15 cm depth and contained 10 ml of 70/30 *v/v* alcohol/glycerol mix. Greenslade and Greenslade (1971) have demonstrated that this preservative is non-attractive to ants although some other invertebrates may be attracted. Following a one-week settling-in period the traps were uncorked and left open for seven days. In order to provide further information on ant distribution a thorough search was made for ant nests along the banks and the time of exposure of land upon which they were found was recorded. The collections were then taken to the laboratory for sorting. With the exception of ants, the invertebrates were scored at the order or family level. Where ant species could not be assigned specific names they were coded with Australian National Insect Collection (ANIC) or Western Australian Institute of Technology Collection (J.D.M.) code numbers. The taxonomy of many Australian ant genera is not well known. Some of the species names given in this paper apply only in a very broad sense and identify what are often species complexes. Therefore, voucher specimens from this study are retained for subsequent study at the Western Australian Institute of Technology.

A 10 by 1 metre strip of ground was marked out adjacent to each pitfall trap and parallel with the water's edge. The numbers, and species, of plants and percentage cover in this area were scored. Since the plants were sparsely distributed a thorough search was made along the banks for additional species and the exposure times for collection sites were recorded.

Results

The mean numbers of plant individuals per transect and their frequency at each exposure zone are shown in Table 1. As with the ants, they are listed in decreasing order of colonising ability. Thirteen species were recorded in the transects, all of which are native to the area. The more extensive search for additional species revealed the following plants; down to 1.5 month zone *Hypochoeris radicata* L.; down to 16 month zone *Gomopholobium marginatum* R.Br., *Dittrichia viscosa* (L.) W. Greuter, *Viminaria juncea* (Schrad. and Wendl.) Hoffmanns; down to 54 month zone *Bossiaea aquifolium* Benth., *Daviesia* sp. indet., *Grevillea bipinnatifida* R.Br., *Cryptandra* sp., and down to 67 month zone *Hakea petiolaris* Meissn., *Hovea trisperma* Benth., *Lasiopetalum floribundum* Benth., *Synaphea petiolaris* R.Br., *Mirbelia spinosa* Benth., *Scirpus* sp. With the exception of *H. radicata* (a flatweed) and *D. viscosa* (Stinkwort), all are native species.

TABLE 1

Mean number and frequency of plants growing in 20 transects situated on ground exposed for different periods of time along the bank of the Canning Dam reservoir.

Species	Mean numbers per transect					Frequency/20 transects				
	Exposure time (months)					Exposure time (months)				
	67	54	16	5	1.5	67	54	16	5	1.5
Grevillea trifida (R. Br.) Meisn.	0.1	0.1	0.1		0.1	6	1	2		1
Amaranthus viridus L.	0.9	0.3			0.1	6	6			1
Eriostemon sp.?	0.1	0.2	0.1	0.3		1	1	1	2	
Kennedia prostrata R. Br.			0.1	0.3			3	1		
Acacia pulchella R. Br.	0.1	0.1	0.1			1	2	2		
Lepidosperma angustatum R. Br.	0.1	0.2	0.1			2	3	1		
Baeckea camphorosmae Endl.	0.1		0.1			1		1		
Eucalyptus calophylla Lindl.	31.2	3.5				11	16			
Hakea undulata R. Br.	0.9	0.1				2	1			
Daviesia cordata Sm.		0.7					2			
Daviesia horrida Preiss ex Lehm.	0.5					3				
Phyllanthus calycinus Labill.	1.3					2				
Gen. indet.	0.1					1				

Plant cover ranged from 0% at the 1.5 month exposure zone to between 1-5% at the 67 month zone. Isolated patches of dense *E. calophylla* covered up to 30% of ground in very restricted areas of the 67 and 54 month zones.

Twelve species of ants were collected in the pitfall traps. The mean numbers of each species per trap and their frequency out of the twenty traps at each exposure zone are shown in Table 2. The ants are listed in decreasing colonisation ability. This was assessed in terms of how far down the banks they were sampled and also their abundance in traps at each zone. The asterisks on Table 2 indicate the lowest exposure zone where nests of a

particular species were found. Nests of five species were found which were not sampled in the pitfall traps. These are also shown in Table 2.

Table 3 shows the mean numbers of the other arthropods collected in pitfall traps. The values should not be used for comparison between taxa since mobility of the animal influences catch as does the fact that it may be attracted to the alcohol preservative (Greenslade and Greenslade, 1971). The counts are useful for indicating the range of taxa present on the banks and also their relative abundance levels in different exposure zones.

TABLE 2

Numbers represent mean number and frequency of ants sampled by pitfall traps situated on ground exposed for different periods of time along the bank of the Canning Dam reservoir. Asterisks indicate the lowest level where nests of a particular species were found. Five of the species were not sampled in the pitfall traps.

Species	Mean numbers per trap					Frequency per 20 traps				
	Exposure times (months)					Exposure times (months)				
	67	54	16	5	1.5	67	54	16	5	1.5
Rhytidoponera inornata (Crawley)	1.7	4.1	3.6	0.6	0.1*	10	11	13	4	2
Cardiocondyla nuda (Mayr)	0.2	0.2	0.2		0.3	3	2	2		2
Camponotus sp. J.D.M. 25	0.2	0.1		0.1	0.1	1	1		1	1
Iridomyrmex purpureus (Fr. Smith)	1.0	1.0*	0.7	0.4		6	4	5	4	
Rhytidoponera violacea (Forel)	1.9	0.3*	0.7	0.4		10	3	3	2	
Camponotus sp. J.D.M. 68	1.1	0.1		0.4		7	1		1	
Iridomyrmex sp. 21 (ANIC)	0.6	0.4	0.1*			4	4	1		
Brachyponera lutea (Mayr)			*							
Iridomyrmex sp. J.D.M. 217			*							
Camponotus sp. J.D.M. 182	1.0	0.2				6	3			
Melophorus sp. 1 (ANIC)	0.3	0.1*				4	1			
Polyrachis sp. J.D.M. 390	0.1	0.1				2	1			
Tapinoma sp. J.D.M. 134		1.3					2			
Monomorium sp. 2 (ANIC)		*								
Camponotus sp. J.D.M. 285	0.1					1				
Myrmecia sp. J.D.M. 5	*									
Iridomyrmex conifer (Forel)	*									

TABLE 3

Mean number of arthropods (excluding ants) sampled by pitfall traps situated on ground exposed for different periods of time along the bank of the Canning Dam reservoir.

Arthropod group		Mean numbers per trap				
		Exposure times (months)				
		67	54	16	5	1.5
Arachnida –	Scorpiones	0.05				
	Opiliones	0.05				
	Araneae	0.75	1.60	0.95	0.80	3.05
	Acarina	0.40	1.90	1.60	0.70	0.40
Chilopoda						0.10
Collembola		∝*	∝	∝	∝	∝
Insecta –	Dermaptera	1.65	0.85	0.30	0.70	0.40
	Blattodea	0.05				
	Orthoptera	10.30	6.15	5.65	4.10	0.50
	Coleoptera	6.50	1.50	2.45	1.30	0.60
	Diptera	0.55	0.25	0.45	0.65	0.30
	Hymenoptera	0.05		0.10		0.05
	Larvae	0.05	0.05	0.10	0.25	0.05

* Abundant in traps at all exposure levels.

Discussion

This survey has demonstrated that at least 26 plant and 17 ant species are capable of colonising the reservoir banks within 67 months of exposure.

These numbers compare with approximate species counts of 150-200 plants (D. T. Bell, pers. comm.) and 120 ants (Majer, 1980a) in the adjacent forest.

Most of the plants are represented in the adjacent forest, the two weeds being the exceptions. *Viminaria juncea* is largely confined to disturbed areas within forest such as roadsides; many of the other species are common in the post-fire succession of the Jarrah forest (Bell and Koch, 1980). The nectar, seeds and herbivores associated with the plants on the upper slopes would provide a limited food-base for certain consumers. Another important food source is the decaying tree stumps and branches, which were present all over the banks, and organic detritus which has been washed up on the shore. The abundance of dead plant matter is reflected by the preponderance of decomposers in the pitfall traps (e.g. certain Acarina and Coleoptera, Collembola and Orthoptera-Gryllidae). Although a number of these taxa may be attracted to the alcohol preservative (Greenslade and Greenslade, 1971), occurrence in traps reflected their observed general abundance in the different exposure zones. The increase in abundance of these taxa with increasing exposure time appeared to be associated with the plant material becoming more amenable to attack by decomposers.

The restriction of the larger predators, the Scorpiones and Opiliones, to the upper zones suggests that food availability is inadequate for these animals in the more recently exposed areas. Although spiders were present in the lower zones, they were all minute and hence required smaller amounts of food than the larger predators.

The occurrence of ants in pitfall traps does not necessarily indicate residence in that area since many species are capable of foraging considerable distances. Incidence of nests in a particular zone is therefore a more reliable indicator of colonising ability. Nests of six of the species were not located although their frequency in traps or their known restricted foraging ability indicated that most of them had nests on the reservoir banks. The possible exceptions are *Polyrachis* sp. J.D.M. 390 and *Camponotus* sp. J.D.M. 285 which may have foraged from the adjacent forest.

All but three of the ant species found on the reservoir banks are also present in the adjacent forest (J. D. Majer, unpublished data). The exceptions are *Cardiocondyla nuda*, which is a tramp species, *Iridomyrmex purpureus* [small purple form (Halliday, 1979)], a native species which in this part of the Jarrah forest only occurs in quarries and along roadsides, and *Polyrachis* sp. J.D.M. 390 has only previously been collected in the more open wandoo (*Eucalyptus wandoo* Blakely) woodlands near Kojonup (J. D. Majer, unpublished data).

All species found on the banks nest in soil or in subterranean dead wood. The ants are largely represented by species of *Iridomyrmex, Camponotus* and *Rhytidoponera*, all of which are generalist feeders. The *Iridomyrmex* and *Camponotus* species are all able to utilise live or dead invertebrates and also nectar from various sources. Both *Rhytidoponera* species collect live or dead

invertebrates and also a wide variety of seeds (Majer, 1980b). *Melophorus* sp. 1 mainly consumes seed but animal material is also taken (J. D. Majer *et al.*, unpublished results). This species was only found down to the 54 month exposure zone, below which few plants were mature enough to produce seed.

Further insight into the colonising ability of these ants may be obtained by comparing the dam ants with those colonising rehabilitated bauxite mines, surveyed between 1 and 13 years following revegetation (J. D. Majer *et al.*, unpublished results). The following ants from the present study were also found in revegetated mines; *Rhytidoponera inornata, R. violacea, C. nuda, Iridomyrmex conifer, I. purpureus* and *I.* sp. 21 (ANIC) in mines revegetated two years previously; *Brachyponera lutea, Monomorium* sp. 2 (ANIC) and *Melophorus* sp. 1 (ANIC) in mines revegetated three years previously. None of the *Camponotus* species from the banks were found in the mines. The reason for this may be the absence of abundant dead timber for nesting in mined areas. The comparison shows that there is a large similarity between the species of ants which colonise these two types of disturbed land. Furthermore there is a reasonable concordance between the time taken by certain ants to colonise bauxite mines and the exposed banks of the dam.

A number of studies on the ecology of southwest Australian ants and the influence of disturbance on certain species have been completed or are in progress. The data from this survey will ultimately be integrated with these studies in order to provide a greater understanding of how environmental factors influence ant communities and individual species.

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